SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27.....Sieve Analysis of Fine and Coarse Aggregates
T96.....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
T99.....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
T104.....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
T180.....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
T191.....Density of Soil In-Place by the Sand-Cone Method

C. American Society for Testing and Materials (ASTM):

A325.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A370.....Definitions for Mechanical Testing of Steel Products
A490.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
C31.....Making and Curing Concrete Test Specimens in the Field
C33.....Concrete Aggregates
C39.....Compressive Strength of Cylindrical Concrete Specimens

C109.....Compressive Strength of Hydraulic Cement Mortars
C138.....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140.....Sampling and Testing Concrete Masonry Units and Related Units
C143.....Slump of Hydraulic Cement Concrete
C172.....Sampling Freshly Mixed Concrete
C173.....Air Content of freshly Mixed Concrete by the Volumetric Method
C330.....Lightweight Aggregates for Structural Concrete
C567.....Density Structural Lightweight Concrete
C780.....Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019.....Sampling and Testing Grout
C1064.....Freshly Mixed Portland Cement Concrete
C1077.....Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314.....Compressive Strength of Masonry Prisms
D698.....Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143.....Piles Under Static Axial Compressive Load
D1188.....Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556.....Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557.....Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166.....Unconfined Compressive Strength of Cohesive Soil
D2167.....Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216.....Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922.....Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974.....Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
D3666.....Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials

D3740.....Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material
E94.....Radiographic Testing
E164.....Ultrasonic Contact Examination of Weldments
E329.....Agencies Engaged in Construction Inspection and/or Testing
E543.....Agencies Performing Non-Destructive Testing
E709.....Guide for Magnetic Particle Examination
E1155.....Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):
D1.1-07.....Structural Welding Code-Steel

1.3 REQUIREMENTS

A. Accreditation Requirements: Testing Laboratory retained and paid for by Contractor, must be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to the Contracting Officer's Representative (COR) a copy of the Certificate of Accreditation and Scope of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the COR for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.
   1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E329.
   2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C1077.
   3. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D3740.
   4. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
   5. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.
   6. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by the COR or Memorial Service Network (MSN) Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of the COR and MSN Engineer to such failure.

C. Written Reports: Testing laboratory shall submit test reports to the COR, MSN Engineer, Contractor, and Local Building Authority within 24 hours after each test is completed unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to cor immediately of any irregularity.

1.4 CONTRACTOR SUBMITTALS

A. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.

B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

1.5 TESTING AGENCY/LABORATORY RESPONSIBILITIES

A. Test samples of mixes submitted by Contractor.

B. Provide qualified personnel at site. Cooperate with COR and Contractor in performance of services.

C. Perform specified sampling and testing of Products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify COR and Contractor of observed irregularities or nonconformance of Work or Products.

F. Perform additional tests required by COR.

G. Attend preconstruction meetings and progress meetings.

1.6 TESTING AGENCY/LABORATORY REPORTS

A. After each test, promptly submit two copies of report to the COR, MSN Engineer and Contractor.

B. Include:

1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection:
5. Identification of product and specifications Section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

C. When requested by COR, provide interpretation of test results.

1.7 LIMITS ON TESTING AGENCY/LABORATORY AUTHORITY

A. Testing agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Testing agency or laboratory may not approve or accept any portion of the Work.

C. Testing agency or laboratory may not assume any duties of Contractor.

D. Testing agency or laboratory has no authority to stop the Work.

1.8 CONTRACTOR RESPONSIBILITIES

A. Deliver to testing agency/laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.

B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

C. Provide incidental labor and facilities:
   1. To provide access to Work to be tested.
   2. To obtain and handle samples at the site or at source of products to be tested.
   3. To facilitate tests.
   4. To provide storage and curing of test samples.

D. Notify COR, MSN Engineer, and Laboratory 24 hours prior to expected time for operations requiring testing services.

E. Employ services of an independent qualified testing laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

1.9 SCHEDULE OF TESTS

A. Individual Specification Sections: Tests required and standards for testing.

B. Summary of Tests required are shown in Part 3. The approximate numbers of tests are shown for reference only. Contractor shall provide sufficient number of tests to satisfy Testing requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
   1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
   2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide part time

observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.

3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698, and in no case fewer than three (3) tests, locations to be independently selected by COR and testing laboratory personnel.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556 or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR and MSN Engineer before the tests are conducted.

    a. Foundation Wall Backfill: One test per 100 feet of each layer of compacted fill but in no case fewer than two tests.
    b. Trenches: One test at maximum 100 foot intervals per 2 foot of vertical lift and at changes in required density, but in no case fewer than two tests.
    c. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to the COR. In each compacted fill layer below wall footings, perform one field density test for every 100 feet of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.

C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.

D. Testing Materials: Test suitability of on-site and off-site borrow as directed by the COR.

3.2 MASONRY

A. Mortar Tests:
   1. Laboratory compressive strength test:
      a. Comply with ASTM C780.
      b. Obtain samples during or immediately after discharge from batch mixer.
      c. Furnish molds with 2 inch, 3 compartment gang cube.
      d. Test one sample at 7 days and 2 samples at 28 days.
   2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:
   1. Laboratory compressive strength test:
      a. Comply with ASTM C1019.
      b. Test one sample at 7 days and 2 samples at 28 days.
      c. Perform test for each 2,500 square feet of masonry.

C. Masonry Unit Tests:
   1. Laboratory Compressive Strength Test:
      a. Comply with ASTM C140.
      b. Test 3 samples for each 5,000 square feet of wall area.

3.3 STRUCTURAL STEEL

A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.

B. Prefabrication Inspection:
   1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
   2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
   3. Approve welder qualifications by certification or retesting.
   4. Approve procedure for control of distortion and shrinkage stresses.
   5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.

C. Fabrication and Erection:
   1. Weld Inspection:
      a. Inspect welding equipment for capacity, maintenance and working condition.

b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
e. Measure 25 percent of fillet welds.
f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
   1) 20 percent of all shear plate fillet welds at random, final pass only.
   2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
   3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
g. Verify that correction of rejected welds are made in accordance with AWS D1.1.
h. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

2. Bolt Inspection:
   a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
   b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
   c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
   d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
   e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.

f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COR and MSN Engineer.

3.4 TYPE OF TEST

	Approximate Number of Tests Required
A. Earthwork:	
Laboratory Compaction Test, Soils (ASTM D698)	0
Field Density, Soils (ASTM D6938)	0
B. Masonry:	
Sampling and Testing Mortar, Comp. Strength (ASTM C780)	3
Sampling and Testing Grout, Comp. Strength (ASTM C1019)	3
Masonry Unit, Compressive Strength (ASTM C140)	3
C. Structural Steel:	
Magnetic Particle Testing of Welds (ASTM E709)	3

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